as per the requirement of comfort temperature. Building design is greatly influenced by the severity and climatic variations leading to the need for integrating the building thermal design with the overall design process, helping the designer to decide at the beginning of the design process to bring the built space into comfort conditions (Al-Homound, 1997; Liu et al., 2010). The important parameters required for the design of energy efficient buildings are walls, roof, placement and size of openings, and shading devices (Charde and Gupta, 2013)**.** Building envelope like walls and roofs have important role to play in the heat transfer process between the indoor and outdoor environment of the building. Due to the quest for achieving better thermal comfort standard inside the building leads to higher heating and cooling energy requirements. Borah *et al.* reported that energy consumption for heating will be higher at higher base temperature and the energy consumption due to cooling of the buildings will be higher at lower base temperatures in the buildings of North-East India (Borah et al., 2015).The components of the building envelope can be used as the most effective way of controlling the indoor temperature of the building (Dutta, 2001). Simulation tools such as TRNSYS can be used effectively to study the effect of building envelope characteristics on indoor thermal environments. Singh *et al.* have done thermal performance simulation of three vernacular buildings at different bioclimatic zones of the north-eastern region by using TRNSYS simulation tool (Singh et al., 2009b). Simulation results concluded that the houses are fairly comfortable in pre-winter and pre-summer months compared to winter and summer months and successfully compared with the experimental results. Kalogirou *et al.* investigated the effects of the application of building thermal mass in Cyprus by modeling and simulating a typical house with the TRNSYS simulation program (Kalogirou et al., 2002). Jindal *et al.* analyzed the thermal performance of non-conditioned building of cold regions by using various insulation thicknesses at different positions of walls and roof. It is found that the thermal comfort for the three cold stations i.e. Srinagar, Shimla and Shillong cannot be ensured in the month of January if the building is not insulated (Jindal et al., 2013). The effect of insulation thickness on external walls in different seasons of the year in different climatic zones suggests that optimization of insulation thickness on external walls with respect to cooling loads is found to be more appropriate for energy savings compared to the heating loads (Bolatturk, 2008; Ozel, 2011; Yu et al., 2009). Al-Sanea *et al.* investigated the effects of location of thermal mass in insulated building walls on total and peak transmission loads, time lag, decrement factor, and dynamic resistance under the steady periodic conditions using climatic data of Riyadh. It is found that for a given thermal mass, a wall with outside insulation provides better overall performance than a wall with inside insulation (Al-Sanea et al., 2013). Asan investigated the effects of wall's insulation thickness and position on time lag and decrement factor. It is found that insulation thickness and position have intense effect on time lag and decrement factor (Asan, 1998). Axaopoulos *et al.* analyzed the thermal behavior of external walls using TRNSYS and determined the optimum insulation thickness for the external walls of a residential building in Athens, Greece, considering wall construction, orientation, wind direction and the position of insulation (Axaopoulos, 2014). Huang *et al.* found that the variation in the window to wall ratio for different orientation results into different economical thermal insulation thicknesses of building envelope (Huang et al., 2014). It is also found that the optimum performance can be achieved by considering the windows-to-wall ratio, house orientation, types of insulating materials and windows in addition to the impact of the windows and walls.

Building energy simulation tools are widely used for thermal performance study of building. In this study, a building model generated in TRNSYS 16 is used to analyze the indoor thermal environment of a typical vernacular building at Tezpur, in warm and humid climatic zone of North-East India. Most of the houses of the region are constructed in direct response to the climatic constraints and are naturally ventilated (Singh et al., 2010). A building model is prepared based on the inputs like building construction details, thermo-physical properties of building materials, wall thickness and insulation thickness on external wall using TRNSYS simulation tool. The layout of the building considered for the base case is shown in Figure 1. Windows on the house are distributed on all the facades. It is a single zone house with flat roof and single glazed windows. Since the vernacular house is naturally ventilated, so auxiliary heating, cooling and mechanical ventilation are kept off for all the simulations and the zone air temperature is considered as the primary output parameter.The simulation provides the results in terms of hourly temperature profile inside the zone of the building. Indoor temperature variation for all the simulations is compared with the base case and the results are analyzed to obtain the optimum design parameters. An optimum thermal performance of the building has been achieved by integrating the building optimum design parameters.

performance, showing that insulation applied on the outside surface have less temperature swing. The effect of different insulation material on the wall surface temperature has also been studied and polyurethane has been found showing the best performance. This study also reveals that windows with double glazing have maximum effect in winter when the sun's altitude is less. Hence, if the window is replaced by proper shading mechanism then overall performance can be improved. It is found that increase in the window to wall ratio has significant effect on the indoor temperature swing. Increase in the window area leads to maximum hours of discomfort inside the building in both January and July months. It can also be concluded that providing insulation to the roof has negligible effect on the indoor temperature profile. Time lag and decrement factor are also calculated for different wall thicknesses. It is found that thermal mass of the wall and thermo-physical properties of the wall have a profound impact on time lag and decrement factor. The findings of this study also relate to the policy intervention and best practice needs to be followed in these types of building design. North-Eastern region is in development process and the construction sector is rising in unprecedented way. These types of buildings are well suited to the climatic factors as well as social requirements of the people of the region. Hence, the findings of this study could be useful to the policy makers, architects, and local people for designing better thermally comfortable buildings.

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